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Statistical properties of GRB afterglow parameters as evidence of cosmological evolution of their host galaxies

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Abstract

The results of a study of 43 peaked R-band light curves of optical counterparts of gamma-ray bursts with known redshifts are presented. The parameters of optical transients were calculated in the comoving frame, and then a search for pair correlations between them was conducted. A statistical analysis showed a strong correlation between the peak luminosity and the redshift both for pure afterglows and for events with residual gamma activity, which cannot be explained as an effect of observational selection.This suggests a cosmological evolution of the parameters of the local interstellar medium around the sources of the gamma-ray burst. In the models of forward and reverse shock waves, a relation between the density of the interstellar medium and the redshift was built for gamma-ray burst afterglows, leading to a power-law dependence of the star-formation rate at regions around GRBs on redshift with a slope of about 6.

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Keywords

Gamma-ray bursts, Optical afterglows, Statistical study